

MONTHLY WEATHER REVIEW,

MAY, 1880.

(General Weather Service of the United States.)

WAR DEPARTMENT,

Office of the Chief Signal Officer,

DIVISION OF

TELEGRAMS AND REPORTS FOR THE BENEFIT OF COMMERCE AND AGRICULTURE.

INTRODUCTION.

In preparing this REVIEW the following data, received up to June 15th, have been used, viz: the regular tri-daily weather charts, containing the data of simultaneous observations taken at 139 Signal Service stations and 13 Canadian stations, as telegraphed to this office; 147 monthly journals and 153 monthly means from the former, and 13 monthly means from the latter; reports from 27 Sunset stations; 209 monthly registers from Voluntary Observers; 28 monthly registers from United States Army Post Surgeons; Marine Records; International Simultaneous Observations; monthly reports from Voluntary Observers in, and the local Weather Service of, Missouri; reliable newspaper extracts; special reports.

BAROMETRIC PRESSURE.

The general distribution of the atmospheric pressure for the month of *May*, 1880, over the United States and Canada is shown by isobaric lines on chart No. II. At a few outlying stations the barometric means are given in figures (English inches.) The regions of highest pressure are found to cover the Middle and South Atlantic States and North Pacific coast region, the maximum means being reported from stations along the immediate coast of North Carolina. The region of lowest pressure covers the Red River of the North valley, the minimum mean for the whole country being reported by Pembina, Dak.

Departures from the Normal Values for the Month.—By comparison with the average of the means for the months of May for the past eight years, those for the present month (May, 1880) show a decided excess of pressure over the region of highest barometer along the Atlantic coast, and a large deficiency over Dakota, Minnesota and northern Wisconsin, or the region of lowest barometer. The deviations have ranged about as follows: an excess of from 0.04 inch at Jacksonville to 0.11 inch at Cape Hatteras in the South Atlantic States; from 0.07 to 0.02 from New England and the Middle States to the Ohio valley and Eastern Gulf States; and from 0.01 at Portland, Oregon and San Diego to 0.07 at San Francisco. Elsewhere a general deficiency has occurred, amounting to about 0.04 in the Southwest, along the eastern slope of the Rocky Mountains and in the Upper Lake region, and which gradually increased toward the region of lowest pressure until it reaches 0.13 at Breckenridge and 0.18 at Pembina.

Barometric Ranges.—As reduced to sea-level the total monthly range of the barometer gradually increases from south to north. It amounts to 0.40 inch at Key West and Indianola and 0.38 at Santa Fe, N. M., and Los Angeles, California; 0.55 on the North Carolina coast, 0.78 at Cairo, 0.68 at Denver and 0.47 at San Francisco; 0.66 at New York, 1.00 at Chicago and 0.86 at Roseburg, Oregon; and 0.84 at Eastport, 1.05 at Alpena, 0.92 at Breckenridge and 0.98 at Olympia.

This Paper is furnished by the Government of the United States, without charge to the Co-operating Observers acting with the Signal Office in the collection of Simultaneous Reports.

Areas of High Pressure.—Only five high areas of any importance have appeared during the month of May within the limits of the Signal Service Maps. The most important area was No. III., which first developing in the Upper Lake region on the 10th, remained over the Lakes, Tennessee, Ohio valley, Middle and South Atlantic States until the 17th.

No. I.—On the 1st a high area was central in the Southern States, the pressure being in general 0.3 above the normal. The minimum temperatures for the month for all the country east of the Mississippi river occurred this day. On the 2nd, with slowly diminishing pressure, this high area moved slowly eastward to the Carolina coast. On the 3rd and 4th it was dissipated by the advance of low area No. I, then moving in a northeasterly track along the Atlantic coast. Cautionary signals were ordered on the 1st at Indianola and Galveston, in connection with this high area and a depression near the Mexican coast; they were justified by the following maximum velocities: Indianola, E. 51; Galveston, NE. 41.

No. II.—On the 5th there was a very rapid rise of pressure on the Pacific coast in rear of low barometer No. III. The high area, slowly diminishing in pressure, remained nearly stationary in position until the 9th, when it became dissipated in advance of low area No. V. then approaching the coast from the Pacific Ocean. Considerable rain fell in Washington Territory and Oregon, and occasional rain in northern California.

No. III.—On the 10th there was a great rise in pressure in the Northwest in rear of low area No. IV., the highest barometer being central in the Upper Mississippi valley. 11th, the high pressure moved slowly to the eastward, central over Lake Michigan. 12th, the highest barometer was transferred to the Lake Superior region. 13th, slightly increasing in pressure, the high area remained central over the Upper Lakes, the barometer being generally 0.3 above the normal. 14th, still slowly increasing in pressure the centre of high barometer was transferred to the region of Lake Huron; Alpena barometer at the afternoon report being 0.49 above the normal. On the morning of the 15th the isobar of 30.40 included nearly all the Lake region and extended into Ohio, West Virginia, and Pennsylvania. During the day there was a general diminution in pressure over this area. On the 16th it was transferred to the South Atlantic States. 17th, it was dissipated as a high pressure in advance of low area No. IV., then central in Dakota. This high area was remarkable for the persistence with which it remained in the Lake region. During its continuance the weather within the limits of the isobars of high barometer was unusually clear and pleasant. High winds are reported in connection with this area from Thatcher's Island north, to Cape Hatteras south. Cautionary Off-shore Signals were ordered on the 13th from Chincoteague to Eastport, which were justified by the following maximum velocities: Chincoteague, NW. 30; Delaware Breakwater, N. 32; Cape May, NW. 27; Sandy Hook, NW. 36; New Haven, N. 25; Thatcher's Island, NE. 47. Also Cautionary signals were ordered from Cape Henry to Wilmington. The following maximum velocities were reported: Cape Henry, N. 35; Kittyhawk, NE. 44; Cape Hatteras, NE. 32; Cape Lookout, NE. 36. The temperature within the limits of high barometer was below the mean.

No. IV.—On the 23rd there was a rapid rise of pressure on the Pacific coast in rear of depression No. VIII. Alternately slowly falling or rising the barometer remained above the normal in this region until the end of the month. During its continuance the weather within the limits of the isobars of high barometer remained fair and cool. Brisk northerly winds prevailed in California.

No. V.—On the 28th a high barometer extended over the Lower Lake region and the Middle States. On the 29th the high pressure was transferred to New England, and on the 30th to the Maritime Provinces of Canada. On the 31st it disappeared beyond Nova Scotia in advance of low area No. X.

Areas of Low Pressure.—Ten areas of low barometer are charted for the month. Of these, three (Nos. III, V, VIII,) first appeared on the Pacific coast, and are charted across the Rocky Mountains, but no depression crossed the entire continent within the limits of the charts of the Signal Service. The most remarkable low-area is No. I, whose track is charted farther to the south than any depression in the month of May since the organization of this Service.

No. I. - On the 1st and 2d, the circulation of the winds in Texas showed the development of a storm-centre near the mouth of the Rio Grande. On the 3d, the low area apparently moved in an easterly track over the Gulf of Mexico; that night the centre of the depression crossed Florida, between Punta Rasa and Cedar Keys, as shown in chart No. I. On the 4th, the storm-centre moved in a northeasterly track near the South Atlantic coast. At the morning report of the 5th, the winds show that the centre of the storm was a short distance east of the North Carolina coast. Its track on that day is too indefinite to locate the centre of the depression at the hours of simultaneous observations, but, as charted, the low-area continued a northeasterly track until the morning of the 6th, when the centre can be located south of Nova Scotia and east of Maine. In its passage over Nova Scotia on the 6th, the storm developed great energy. Cautionary Signals were ordered in advance of this storm from Port Eads to Cedar Keys on the 2d; from Savannah to Cape May on the 4th and at Eastport on the 6th. The following maximum velocities are reported: Cedar Keys, SE. 25; Charleston, NE. 25; Macon, SE. 32; Cape Lookout, SE. 40; Cape Hatteras, SE. 47; Kittyhawk, NE. 38; Chincoteague, NE. 39; Eastport, N. 27. The storm track, except in Florida and in Nova Scotia, is charted at sea. The following are marine reports referring to this storm: Brig. Sisters at New York, May 9th, from Peruambuco reports heavy SE. gale on May 4th, lasting ten hours. Ship Niagara, May 5, off Hatteras, stove bulwarks, &c., during NE. gale. Bark Windermere, at New York, May

7th, from Colombo, Jan. 31st, had revolving hurricane May 5th, lasting seven hours, during which, stove bulwarks, &c. Brig. Edith Hall, at New York, May 10th, from Bahia, reports May 5th, terrific SE. gale and tremendous sea. Steamer Totaze, at New York, May 8th, from Barrow, had hurricane, May 6th, from SE. to W., lasting several hours, with terrific sea, sweeping decks. Bark Elinor, in 37° N. 70° W., May 6th, (?) had hurricane from NE. to SW., lasting twenty-four hours, during which she lost topmast, &c. The progress of this depression over the Gulf and along the States was marked by abundant rain near the line of coast.

No. II.—On the 5th, a slight depression moved in a southeasterly track over the Province of Quebec. During the night, it crossed New England, uniting on the morning of the 6th, with low-area No. I. After this junction, Nos. I and II showed a greatly increased development in energy.

No. III.—On the 4th, there was a rapid fall in pressure on the coast of Washington Territory and Oregon; the barometer at Roseburg, 0.43 below the normal; at Portland, 0.42 below the normal. On the 5th, the depression advancing rapidly to the east crossed the Rocky Mountains and was central at the 11 p. m. report in Montana and Nebraska; the barometer being below the normal at Fort Buford, 0.65; at Fort Stevenson, 0.63. On the 6th, the storm-area moved with diminishing energy in a southeasterly track into Iowa, the barometer slowly rising at the centre of the depression. At the end of this day, the lowest reading of the barometer was at Omaha, Neb., 29.45, only 0.41 below the normal. The 7th—in the morning, the centre of depression was located near Des Moines, Iowa. That day, the storm-centre pursued a northeasterly track over Wisconsin and the Lake Superior region, beyond the limits of the map. Cautionary Signals were ordered in advance of this storm on the a. m. report of the 7th for all ports in the Lake region. These signals were justified as to Lakes Michigan and Huron by the following maximum velocities: Grand Haven, SE. 30; Milwaukee, S. 35; Escanaba, S. 30; Alpena, SE. 30. On the North Pacific coast, this storm was specially severe. Twenty-five fishermen are reported drowned and some ten or fifteen of their boats lost.

No. IV.—On the 8th a depression developing east of the Rocky Mountains moved in an easterly track over Dakota; during its passage heavy rains fell in the Northwest. On the 9th the centre of the depression passed over Minnesota and Lake Superior, and the rain extended over the Upper Lake region and Ohio valley. On the 10th the low area is charted as moving in an easterly track north of the Lower Lakes. Cautionary Signals were ordered for this storm, on the morning of the 9th, for the Upper Lake region and on Lake Erie, to include Sandusky; on the morning of the 10th, to include the remaining ports in the Lower Lakes; maximum wind velocities are reported as follows: Chicago, NW. 28; Grand Haven, SE. 39; Milwaukee, SW. 36; Marquette, W. 28; Alpena, SW. 32; Sandusky, W. 40; Cleveland, W. 30; Buffalo, W. 28.

No. V.—On the 10th the barometer had a sharp fall on the North Pacific coast, accompanied by unusually heavy rains for the season, as far south as San Francisco. The rainfall extended on the following day southward to San Diego. On the 11th the barometer read at Portland 0.53 below the normal; during the day the low area moved in an easterly track over Washington Territory and Montana. On the 12th and 13th the depression progressed slowly eastward into Dakota; the barometer continued to rise at the centre of the low area, and its track is not charted after the midnight report of the 13th.

No. VI.—On the 16th a depression developed in Montana and Wyoming. On the 17th it moved slowly over Dakota; the barometer at Breckenridge at the 11 p. m. report, 29.40, being 0.4 below the normal. 18th, the low area moved over Minnesota and Lake Superior. 19th, it crossed the Province of Ontario beyond the limits of the observing stations. The rainfall accompanying this depression was in general confined to the north of the track of the storm-centre. Cautionary Signals were ordered on the 18th in advance of this storm on Lakes Michigan, Huron and Erie, to include Sandusky. These were justified at the following stations by reported maximum velocities: Grand Haven, S. 28; Port Huron, W. 31; Toledo, SW. 25.

No. VII.—At the morning report of the 20th a slight depression was developed in Texas, accompanied with general rains. During the day it moved slowly in a northeasterly track into Arkansas, with rain extending over the Gulf States. On the 21st, rapidly developing in energy, the storm-centre moved up the Ohio valley and became central near Toledo. This day heavy and general rains were reported from Tennessee, Ohio valley and Lower Lake region. On the 22nd the depression advanced in a northerly track over Lake Huron, beyond the limits of the chart. Cautionary Signals were ordered on the 21st for the Lower Lakes and Lake Huron. The following maximum velocities are reported: Buffalo, W. 25; Cleveland, SW. 32; Sandusky, S. 28; Toledo, SW. 32; Detroit, S. 25; Alpena, W. 28.

No. VIII.—At the morning report of the 22nd there was a sharp fall in pressure on the coast of Washington Territory and Oregon. During the day the centre of depression moved in an easterly track. On the 23rd, crossing the Rocky Mountains, it advanced over Montana and Dakota, and entered Manitoba. On the 24th it passed beyond the limits of the map. At the morning report of this day the barometer at Ft. Garry was 0.62 below the normal. The depression was accompanied by abundant rain.

No. IX.—On the afternoon of the 24th the barometer fell decidedly in Nebraska; the pressure at North Platte being 0.34 below the normal. Moving slowly in a northeasterly course the storm-centre at the midnight report of the 25th was near Breckenridge. On the 26th the low area advanced beyond Lake

Superior. The most abundant rain fell north of the centre of depression during the passage of the low area. South of the track precipitation did not, in general, occur until the shifting of the wind to southwest or northwest. It was during the passage of this storm-centre that the maximum temperatures for the month occurred in Missouri, Illinois, Tennessee and the Ohio valley. The warm wave gradually extended eastward and southward, giving unusually high temperatures for May over the entire country east of the Mississippi river.

No. X.—At the morning report of the 29th there was a sharp fall in pressure in Kansas and Missouri, accompanied by rain, extending to the West Gulf coast. During the day the storm, rapidly increasing in energy, moved in a northeasterly track into northern Illinois. On the 30th it moved over Lakes Michigan and Huron into the Province of Ontario. At the morning reports the barometers at Chicago, Grand Haven and Milwaukee were more than 0.5 below the normal. Its passage was marked by abundant rainfall, which extended over all the United States east of the Mississippi river. Cautionary Signals were ordered for this storm for all the Lakes, except Superior. The following maximum velocities are reported: Milwaukee, NW. 28; Grand Haven, E. 26; Alpena, E. 28; Toledo, SW. 32; Sandusky, SW. 36; Cleveland, W. 28; Erie, SE. 28; Buffalo, SW. 29; Rochester, W. 26. On the 31st the low area moved over New England into the maritime provinces of Canada with diminished energy. Signals were ordered on the 30th in advance of this storm from Cape Henry to Eastport. The following are the reported maximum velocities: Cape Henry, S. 25; Chincoteague, SE. 37; Breakwater, S. 34; Atlantic City, SE. 25; Barnegat, S. 30; Sandy Hook, SE. 26; Wood's Holl, SW. 40; Boston, S. 28.

INTERNATIONAL METEOROLOGY.

Three International charts, Nos. IV, V and VI, accompany the present *Review*. They are for the months of *April*, 1880 and *September*, 1878. In the introduction to International Meteorology, in the *April Review*, the numbers "IV and VI" should read "IV and V", and "March, 1878," should read "March, 1880."

Chart No. IV indicates the probable course of the principal storm-areas occurring over that portion of the North Atlantic ocean, lying between the parallels of 35° and 60° N., during the month of *April*, 1880. The characteristic features of the weather, for this month, over the region under consideration, are the long continued period of good weather and—if we except the northwesterly gales from the 2nd to the 6th between the British Isles and 30° W., attending area No. I, and the gales from the 13th to the 21st, attending areas Nos. III, IV and VI,—a remarkable freedom from severe storms. Area No. I is a continuation of low area No. XV of the *March Review*. On the morning of the 1st it had passed to the east of Newfoundland, and was encountered, in about 46° N 40° W. by steamers *Braunsweg* and *Hibernian*; during the day it moved rapidly northeastward, and was followed over the Western Atlantic by an extensive area of high pressure (see high area No. I, *March Review*.) During the 2nd, 3rd, 4th and 5th, it slowly approached the British Isles as an extensive area of very low pressure; the S. S. *Sardinian*, on the morning of the 4th, in 54° N 17° W, reported barometer 29.14, or 740.1, while the British Isles were included by the isobar 29.35, or 745.4. On the morning of the 5th the pressure at Stornoway fell to 28.79, or 731.3, and during the day the wind, at this station, veered from S. to W. with slowly rising barometer. Except during the regime of the two storms, of minor importance, described as low areas Nos. I and II of *April Review*, and which passed to the north of Newfoundland on the 7th and 8th respectively, high pressures and good weather generally prevailed over the western portion of the Atlantic from the 2nd to the 10th, and over the eastern portion from the 7th to the 11th. S. S. *Adriatic*, from New York, on the 1st, to Liverpool, on the 12th, reported high pressures (except 29.97 on the 6th) and clear or fair weather throughout voyage. During the 10th, as the area of high pressures moved eastward over the British Isles, the barometer fell over the Atlantic to the westward, and on the morning of the 11th low area No. IV appeared to be central about 50° N 25° W. S. S. *Celtic*, in 50° N 23° W, reported barometer 29.70, or 754.4, wind SSW, force 4, and rain-squalls; S. S. *Strassburg*, in 49° N. 16° W, 29.89, or 759.2, SE. 2, light rain. On the west side of the centre, S. S. *Nederland*, in 46° N. 29° W., reported barometer 29.85, or 758.1, wind NNE. 3, much rain, and S. S. *Indiana*, in 48° N. 31° W., 29.97, or 761.2, N. 7, hard rain. On the morning of the 12th, the *Celtic* and *Indiana*, sailing westward, had passed into the area of high pressures, then over mid-ocean and which had moved eastward since the morning of the 8th, from the coast of the United States, while the *Strassburg*, in 49° N. 22° W, reported 29.86, or 758.4, E. 4, cloudy, and the *Nederland*, sailing eastward, in 47° N. 25° W, 29.71 or 754.6, N. 6, rain, high sea and squally. Bark *Woodlands*, in 39° N. 20° W., lost boat &c., during a SW. to W. gale, lasting 48 hours, and SW. to SE. winds, force 3 to 5, had become fully established at the Madeiras and over the Spanish Peninsula. During the 12th, 13th, 14th and 15th, this area of low pressure moved slowly east and northward from the neighborhood of the Madeiras to the coast of Ireland as a somewhat severe storm; Bark *Angelo Madre*, on the 14th, about 200 miles north of the Madeiras, experienced a heavy gale, during which she had her decks swept, and four men washed overboard and drowned. On the 15th S. S. *Nederland* in 49° N., 9° W., reported barometer 29.46, or 748.3, wind NNE. 5, much rain and squally. Area No. III passed very slowly eastward, to the north of Newfoundland on the morning of the 13th, being preceded by S'ly winds, force 4 to 9, between 30° and 45° W., and followed by cold north-west gales, snow and hail. S. S. *Celtic*, in 46° N., 39° W., reported barometer 29.76 or 755.9, SSW. 6, and S. S. *Indiana*, in 42° N., 44° W., 29.74 or 755.4, SSW. 9, hard rain. On the morning of the 14th the pressure still continued quite low, but rising slowly, over Newfoundland, while the winds between 30° and 50°